

FROM TESTING TO DEPLOYMENT: A COMPARATIVE ANALYSIS OF AUTONOMOUS VEHICLE REGULATION***

Summary

The rapid development of autonomous vehicles challenges traditional driver-centred legal frameworks and raises important questions concerning safety, responsibility, and regulatory certainty. This article examines whether existing legal frameworks adequately address the regulation of autonomous vehicles and identifies regulatory approaches relevant to Serbia. Drawing on comparative and normative legal methodology, it analyses regulatory models in the United States, the United Kingdom, the European Union, Germany, France, and Australia, before assessing the Serbian regulatory framework. The findings indicate a shift towards ex ante safety assurance, institutional responsibility, lifecycle oversight, and adaptive regulation. Serbia, however, remains focused primarily on the testing of autonomous vehicles and lacks comprehensive rules governing authorisation, responsibility, insurance, data governance, and continuous oversight. The article therefore identifies key elements for the development of a comprehensive regulatory framework for autonomous vehicles in Serbia.

Keywords: Autonomous Vehicles; Autonomous Vehicle Regulation; Comparative Regulatory Frameworks; Safety Assurance; Regulatory Oversight.

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OD TESTIRANJA DO PRIMENE: UPOREDNOPRAVNI PRISTUP REGULISANJA AUTONOMNIH VOZILA

Sažetak

Ubrzani razvoj autonomnih vozila predstavlja izazov za tradicionalne pravne okvire zasnovane na odgovornosti vozača i otvara važna pitanja bezbednosti, odgovornosti i pravne sigurnosti. Polazna osnova u radu je to da li postojeći pravni okviri na odgovarajući način uređuju autonomna vozila, kao i identifikacija regulatornih pristupa relevantnih za Srbiju. Primenom komparativnog i normativnog pravnog metoda analiziraju se regulatorni režimi Sjedinjenih Američkih Država, Ujedinjenog Kraljevstva, Evropske unije, Nemačke, Francuske i Australije, nakon čega se sagledava trenutni regulatorni okvir u domaćem pravu. Rezultati istraživanja uporednopravne analize pokazuju pomeranje ka prethodnom obezbeđivanju bezbednosti, institucionalnoj odgovornosti, adekvatnom nadzoru i prilagodljivoj regulativi. Srbija se, međutim, i dalje prvenstveno fokusira na testiranje autonomnih vozila i nema sveobuhvatna pravila o odobravanju, odgovornosti, osiguranju, upravljanju podacima i kontinuiranom nadzoru. U radu će stoga biti identifikovani ključni elemente za razvoj sveobuhvatnog regulatornog okvira u Srbiji.

Ključne reči: autonomna vozila; regulisanje autonomnih vozila; komparativni regulatorni okvir; pravna sigurnost; regulatorni nadzor.

1. Introduction

The rapid development of autonomous vehicle (AV) technologies has attracted significant legal, public, political, social, and scholarly attention.¹ While public and industry discourse has largely focused on technological development and the performance of autonomous driving systems, the legal and regulatory frameworks

¹ For the purposes of this article, the term “autonomous vehicles” is used as an umbrella term encompassing vehicles equipped with automated driving systems operating at different levels of automation, as classified under the SAE International taxonomy. Although regulatory instruments in some jurisdictions increasingly use terms such as “automated vehicles”, “automated driving systems”, and “vehicles with automated driving functions”, this article uses the broader term “autonomous vehicles” for reasons of conceptual consistency and to reflect the widespread use in the comparative legal literature on advanced vehicle automation technologies. When referring to the terminology of a particular legal instrument, however, the terminology used in that instrument is retained.

governing their testing, deployment, operation, and accountability are equally important. The transition from human-driven to increasingly automated mobility challenges legal rules traditionally premised on continuous human control and raises questions concerning safety, responsibility, legal certainty, and the allocation of liability among the actors involved in autonomous mobility (Alqahtani, 2025, p. 16).

The deployment and operation of AVs are governed by statutes, regulations, technical standards, and administrative mechanisms that establish the conditions under which such vehicles may be tested, approved, placed on the market, and operated on public roads. These frameworks must address not only traditional road traffic and liability issues but also safety assurance, market access, data governance, cybersecurity, insurance, and continuous regulatory oversight (Eastman *et al.*, 2023, p. 1). At the same time, regulators must reconcile public safety and legal certainty with the need for sufficient flexibility to accommodate rapid technological development.

The regulatory response to these challenges varies considerably across jurisdictions. While some legal systems have introduced legislation specifically addressing automated driving technologies, others continue to rely on existing traffic, product liability, and administrative rules, supplemented by regulatory guidance or pilot programs for testing. These differences reflect variations in legal traditions, institutional structures, regulatory approaches, and assessments of the appropriate balance between technological innovation, public safety, legal certainty, and the allocation of liability.

The regulatory challenge therefore extends beyond the question of liability following an accident. Autonomous vehicles require *ex ante* regulatory mechanisms governing testing, safety assurance, type approval, market access, and operational authorisation, as well as mechanisms for monitoring compliance throughout their operational lifecycle. In this context, this article understands deployment not merely as the authorisation to operate a vehicle on public roads, but more broadly as the transition to authorised operation accompanied by continuing regulatory oversight throughout the vehicle's operational lifecycle. The increasing reliance of autonomous vehicles on software, data, connectivity, and artificial intelligence further necessitates regulatory attention to cybersecurity, data protection, software updates, and system reliability (Gordanić & Bećirović Alić, 2026, p. 224). Effective regulation must therefore establish sufficiently clear and predictable requirements while remaining adaptable to technological and societal developments.

Despite the growing body of scholarship on autonomous vehicle regulation, significant differences remain in how legal systems combine existing legal rules with emerging regulatory mechanisms specifically designed for autonomous vehicles. Comparative analysis is therefore relevant not only to identifying differences

among national frameworks but also to determining common regulatory principles and emerging approaches to the governance of autonomous vehicles. In particular, comparison can reveal how different jurisdictions address the transition from testing and experimentation to authorised deployment and continuous regulatory oversight.

Accordingly, this article examines the regulation of autonomous vehicles from a comparative law perspective, focusing on the United States (US), the United Kingdom (UK), the European Union (EU), Germany, France, and Australia. The comparative analysis considers key regulatory dimensions, including testing and market access, safety assurance, allocation of legal liability, operational oversight, and lifecycle regulation. These jurisdictions have been selected because they represent different regulatory approaches and institutional models. They also illustrate distinct stages of regulatory development, ranging from the fragmented federal-state approach in the US to the more structured frameworks developed in the UK, Germany, France, and Australia, while the EU provides a supranational framework that interacts with national regulation.

The article subsequently applies the findings of the comparative analysis to the Serbian regulatory framework. Particular attention is paid to the fact that Serbian regulation remains primarily focused on the testing of autonomous vehicles rather than their broader deployment and operation. The article therefore assesses whether the existing framework provides an adequate basis for the transition from testing to deployment and identifies regulatory elements that may inform its further development. The principal contribution of the article lies in connecting a comparative analysis of established and emerging regulatory models with a jurisdiction-specific assessment of Serbia. The analysis ultimately examines whether the Serbian framework can develop beyond its current testing-oriented approach towards a more comprehensive and technologically adaptable regulatory framework addressing safety assurance, legal responsibility, insurance, data governance, and continuous regulatory oversight.

2. Regulatory Challenges in the Governance of Autonomous Vehicles

The transition of autonomous driving technologies from experimental systems to increasingly sophisticated and potentially marketable mobility solutions requires legal frameworks capable of addressing forms of technological operation that differ fundamentally from conventional human-driven vehicles (Nolte *et al.*, 2025, p. 1). Unlike traditional road traffic regulation, which is largely premised on the presence of a human driver who continuously performs the dynamic driving

task, autonomous driving systems progressively assume functions historically attributed to the driver. This technological shift consequently challenges established legal assumptions concerning control, responsibility, supervision, and compliance with road traffic rules.

One of the principal regulatory challenges concerns the need to establish appropriate *ex ante* mechanisms governing the testing, approval, and deployment of autonomous vehicles. Traditional legal frameworks have generally developed in response to technologies and modes of transportation that were already established in practice. Autonomous driving, by contrast, requires legislators and regulatory authorities to establish legal conditions for technologies whose capabilities and limitations continue to evolve. Regulatory frameworks must therefore anticipate potential risks while avoiding requirements that are either insufficient to protect public safety or so restrictive that they unnecessarily impede technological development (Nolte *et al.*, 2025, p. 1).

In this context, type approval represents an important regulatory mechanism for ensuring that autonomous vehicles satisfy prescribed technical, safety, and operational requirements before being placed on the market or authorised for use on public roads. The regulatory significance of type approval extends beyond technical compliance, as it provides a mechanism through which public authorities can exercise *ex ante* control over technologies whose operation may have significant implications for road safety and public welfare (Nolte *et al.*, 2025, p. 1). At the same time, applying established approval mechanisms to increasingly software-dependent vehicles raises questions concerning the assessment, validation, updating, and continued compliance of automated driving systems.

Testing constitutes a further important regulatory dimension. Because autonomous vehicles are capable of operating under complex and changing traffic and environmental conditions, testing is necessary to evaluate their performance and identify potential safety risks before broader deployment. Legal frameworks governing testing must therefore establish the conditions under which such vehicles may be operated, the responsibilities of entities conducting tests, the degree of human supervision required, and the safeguards applicable to other road users. The regulatory challenge lies in facilitating sufficient real-world testing to support technological development while ensuring that experimental operation does not expose the public to disproportionate risks (Taeihagh & Lim, 2018, p. 103).

The increasing role of software and data in vehicle operation also expands the scope of regulatory concerns beyond conventional vehicle safety requirements. Autonomous vehicles depend on sensors, software, connectivity, data processing, and artificial intelligence, creating additional regulatory issues relating to cybersecurity, data protection, system reliability, software updates, and the integrity of

automated decision-making processes (Kubica, 2022, p. i41). The regulatory framework must therefore address not only the physical characteristics of the vehicle but also the continuing functionality and safety of the technological systems on which automated driving depends.

Equally important is the requirement of legal certainty. Manufacturers, software developers, operators, and users require clear and predictable rules governing the authorisation, operation, supervision, and liability of autonomous vehicles. At the same time, overly rigid regulatory requirements may become obsolete as technological capabilities evolve. The regulation of autonomous vehicles therefore involves a continuing tension between legal certainty and regulatory adaptability. Public authorities must establish sufficiently precise standards to protect public interests while retaining the capacity to modify regulatory requirements in response to technological and societal developments (Sovilj & Zlatanović, 2026, pp. 205–208).

These considerations identify the principal regulatory dimensions arising in the governance of autonomous vehicles, including market access, testing, safety assurance, type approval, human supervision, responsibility, data governance, cybersecurity, and ongoing regulatory oversight. (Taeihagh & Lim, 2018, p. 103). These dimensions provide a conceptual framework for examining the legal responses adopted by different jurisdictions. The comparative analysis that follows therefore considers how selected legal systems address these challenges through their respective legislative and administrative frameworks and how they allocate liability and regulatory oversight among the actors involved in the development, deployment, and operation of autonomous vehicles.

3. Comparative Analysis of Regulatory Frameworks Governing Autonomous Vehicles

The legal regulation of autonomous vehicles remains fragmented across jurisdictions, reflecting differences in regulatory approaches to technological adoption, liability allocation, and operational standards (Roussou *et al.*, 2026, p. 4). This chapter undertakes a comparative analysis of the legal frameworks governing AVs in Australia, France, Germany, the UK, and the US. Significant differences persist among these jurisdictions in their legal, institutional, social, political, and geographical contexts. Variations in public transport infrastructure, mobility needs, and household structures further influence the development of transportation systems and the regulatory approaches adopted for the deployment and operation of AVs (Emory, Douma & Cao, 2022, p. 1). While the US represents a more fragmented

and decentralised regulatory model, the UK, Germany, France, and Australia illustrate different approaches to developing more structured frameworks for the governance of AVs. The EU is examined as a distinct supranational regulatory layer rather than as a national jurisdiction because its rules on type approval, product liability, motor insurance and artificial intelligence directly shape the regulatory space within which Member States such as Germany and France regulate autonomous vehicles. These divergences not only illustrate different legislative responses to technological innovation but also provide a basis for assessing how different regulatory models address the common challenges identified in the preceding section.

3.1. United States:

Federal Oversight and State-Level Governance of Autonomous Vehicles

The US represents one of the earliest jurisdictions to facilitate the testing and development of autonomous vehicles on public roads, largely due to its innovation-oriented regulatory environment and decentralised allocation of regulatory powers (Sovilj & Zlatanović, 2026, pp. 192–193). Rather than adopting a single comprehensive federal framework governing autonomous vehicles, the US regulatory approach has developed through the interaction between federal vehicle safety regulation and state-level rules addressing operational requirements, liability, and insurance.

Federal guidance issued by the National Highway Traffic Safety Administration (NHTSA), including the *Federal Automated Vehicles Policy* (2016) and *Automated Driving Systems: A Vision for Safety* (2017), sought to promote regulatory consistency through voluntary safety guidance and a *Model State Policy* while preserving state authority over liability allocation and insurance requirements. At the federal level, NHTSA exercises its regulatory authority primarily through the *Federal Motor Vehicle Safety Standards* (FMVSS), which establish mandatory safety requirements applicable to motor vehicles and motor vehicle equipment. However, their application to highly autonomous vehicles has required regulatory adaptation due to the absence of human drivers in certain driving functions.² More recently, the federal regulatory framework has continued to evolve through targeted amendments to the FMVSS and the use of exemption mechanisms for vehicles whose design differs from that of conventional vehicles. States are generally responsible

² In 2020, NHTSA established the Automated Vehicle Transparency and Engagement for Safe Testing (AV TEST) Initiative in 2020 as a voluntary information-sharing mechanism designed to increase transparency regarding autonomous vehicle testing activities across the US. Rather than establishing binding regulatory requirements, the initiative sought to facilitate public access to information concerning testing operations and to support engagement among federal authorities, state regulators, industry stakeholders, and the public.

for determining the allocation of liability among manufacturers, owners, operators, and other relevant parties, whereas NHTSA retains authority over vehicle safety and safety-related defects, including those associated with automated driving systems. During the transitional period in which autonomous and conventional vehicles operate concurrently, existing liability regimes are generally expected to remain applicable (Roussou *et al.*, 2026, p. 4).

Despite several legislative initiatives, including the *AV START Act* and the *SELF DRIVE Act*, the US has not adopted a comprehensive federal statute specifically governing autonomous vehicles. These proposals sought to promote greater regulatory uniformity by clarifying federal authority over vehicle safety standards, facilitating the deployment of automated driving systems, and reducing regulatory fragmentation among states. In particular, the *SELF DRIVE Act* sought to clarify the division of regulatory authority by designating NHTSA as the primary federal authority responsible for vehicle safety standards, while limiting state regulation of autonomous vehicles where such regulation would conflict with federal requirements (Taeihagh & Lim, 2018, p. 108). However, the failure of these initiatives to achieve legislative adoption has preserved a regulatory model based largely on existing federal safety regulations and non-binding guidance issued by NHTSA. This reliance on voluntary guidance provides manufacturers with flexibility in developing and testing autonomous vehicles, but has also been criticised for creating uncertainty regarding uniform safety standards, liability allocation, and the conditions for large-scale commercial deployment. Consequently, the US regulatory framework remains characterised by a division between federal oversight of vehicle safety and state-level regulation of operational issues, liability, and insurance.

3.2. United Kingdom:

Evolution of the Regulatory Framework for Autonomous Vehicles

The United Kingdom's approach to autonomous vehicle regulation has historically been shaped by the *Automated and Electric Vehicles Act 2018* (AEVA), which represents an initial legislative response to the legal challenges arising from the transition towards automated mobility (Rosemadi, Khong & Radhakrishna, 2022, p. 157). Rather than establishing a comprehensive regulatory code for autonomous vehicles, the AEVA adopts a framework-based approach, focusing primarily on the allocation of legal responsibility and the creation of mechanisms capable of accommodating future technological developments (Eastman *et al.*, 2023, p. 49).

A central feature of the Act is the establishment of a statutory liability framework under which insurers assume primary responsibility for compensating victims of accidents caused by automated vehicles. By providing victims with a direct

route to compensation through compulsory motor insurance, the AEVA reduces the need to establish human driver fault at the initial stage of the claims process. The insurer is subsequently entitled to recover its costs from the party responsible for the accident. This represents a significant adaptation of conventional road traffic liability models, particularly in circumstances where an accident may result from a failure of the automated vehicle rather than from human negligence.³

However, the AEVA's regulatory scope remains deliberately limited. The Act does not establish a comprehensive regulatory regime addressing safety assurance, technical standards, data governance, cybersecurity, or the broader conditions for the deployment of automated vehicles. Instead, its provisions primarily establish a liability and insurance framework for automated vehicles, leaving broader regulatory requirements to subsequent legislative developments.⁴ In this respect, the AEVA can be understood as an incremental regulatory measure, addressing the immediate legal consequences of automated vehicles without prescribing a comprehensive set of technical and operational requirements at an early stage. This approach laid the foundation for the subsequent establishment, through the *Automated Vehicles Act 2024* (AVA), of a more comprehensive regulatory framework governing vehicle authorisation, safety obligations, and ongoing regulatory oversight.

The AVA establishes the statutory framework governing the authorisation, deployment, and regulatory oversight of autonomous vehicles. At the core of the Act lies the statutory self-driving test, which serves as the principal legal criterion for determining whether a vehicle qualifies for self-driving authorisation under the Act. By placing this statutory assessment at the centre of the authorisation process, the AVA shifts regulatory attention from post-accident liability towards ex ante safety assurance. Lawful market access therefore becomes conditional upon demonstrable compliance with statutory safety standards.⁵ The statutory test is complemented by a Statement of Safety Principles, which requires authorised self-driving vehicles to achieve a level of safety at least equivalent to that of a competent and careful human driver (Woolich & Gore, 2024). The Act distinguishes between two operational modes at the approval stage – User-in-Charge (UIC) and No-User-in-Charge (NUIC) – a distinction that constitutes one of its central regulatory innovations by allocating legal responsibility according to the degree of human involvement in vehicle operation (Roussou *et al.*, 2026, p. 7). This differentiated allocation of legal responsibility reflects the Act's underlying risk-based regulatory model, under which legal obligations increase as the role of the human

³ *Automated and Electric Vehicles Act 2018* (c. 18), Part 1, ss. 16–20.

⁴ *Automated and Electric Vehicles Act 2018* (c. 18), ss. 1–5.

⁵ *Automated Vehicles Act 2024* (c. 10), Part 1, s. 2.

driver diminishes. The duty to ensure the continuing compliance of authorised vehicles rests with the Authorised Self-Driving Entity (ASDE) or, in the case of No-User-in-Charge operations, with the licensed NUIC operator responsible for the vehicle's operation.

Under the AVA, responsibility is allocated according to the operational role of each actor: ASDEs are responsible for the continuing compliance of authorised vehicles, NUIC operators bear responsibility for the operation of vehicles during driverless journeys, while UICs remain subject to defined and time-limited expectations concerning the transfer of control. Third-party compensation remains primarily governed by existing motor insurance and tort principles; however, the Act strengthens accountability during automated operation by assigning responsibility to the relevant actors and facilitating access to safety-critical information following incidents (Roussou *et al.*, 2026, p. 7). In doing so, the Act departs from traditional driver-centred liability models by recognising authorised entities responsible for self-driving operations as continuing regulatory actors whose legal responsibilities extend beyond initial vehicle authorisation to encompass ongoing compliance throughout the vehicle's operational lifecycle. The Secretary of State exercises extensive ongoing regulatory and supervisory powers, including the authority to grant, vary, suspend, or revoke authorisations, impose regulatory conditions, and maintain a public register of authorised vehicles. These powers enable continuous regulatory oversight throughout the operational lifecycle of authorised vehicles, reflecting the dynamic nature of autonomous driving technologies and the need for an adaptive regulatory framework.⁶ To strengthen post-incident accountability, the AVA provides regulators with robust investigatory and enforcement mechanisms, including broad information-gathering powers, data-sharing arrangements with insurers, interview and information notices, warrant-based search powers, and a graduated enforcement regime comprising compliance and redress notices, monetary penalties, and criminal offences for providing false or withholding safety-critical information.⁷

Unlike the AEVA, which primarily addressed post-accident liability and insurance, the AVA represents a fundamental shift from a liability-centred legislative framework towards a comprehensive governance model combining market authorisation, institutional accountability, continuous regulatory supervision, and post-deployment compliance. Although parts of the Act have already entered into force, the principal authorisation regime for automated vehicles is expected to become operational in 2027 following the adoption of the necessary secondary legislation.

⁶ *Automated Vehicles Act 2024* (c. 10), Part 1, s. 10.

⁷ *Automated Vehicles Act 2024* (c. 10), ss. 16–22, 28–36.

3.3. European Union:

Fragmented Regulatory Framework for Autonomous Vehicles

At the EU level, there is currently no single comprehensive legislative instrument specifically regulating autonomous vehicles as a distinct legal category. Instead, the regulatory framework relies on the application of existing horizontal legal instruments governing product liability, motor insurance, and artificial intelligence. The *Product Liability Directive* 2024/2853, which repeals Directive 85/374/EEC⁸, establishes a strict liability regime for defective products and may apply to AV-related defects without requiring immediate sector-specific legislation (Chatzipanagiotis & Leloudas, 2020, p. 118). Similarly, the *Motor Insurance Directive* 2009/103/EC provides a framework for victim compensation through compulsory motor insurance, while allowing insurers, where appropriate, to seek recourse against responsible parties, including manufacturers.⁹ However, its effective application to AVs may require further harmonisation concerning concepts such as automated operation and access to vehicle data. In addition, the *Artificial Intelligence Act* (Regulation (EU) 2024/1689)¹⁰ introduces a risk-based ex ante regulatory approach for high-risk AI systems, including certain safety-related AI components integrated into autonomous vehicles, by imposing obligations aimed at ensuring safety, transparency, and the protection of fundamental rights (Mpofy, 2025. p. 5).

This fragmented yet precautionary regulatory approach is also reflected in the EU framework governing the testing and deployment of autonomous vehicles. While AV testing is legally permitted across the EU, the regulatory approach generally places greater emphasis on ex ante safety assessment and the mitigation of technological risks before wider market deployment. In contrast to the more innovation-driven regulatory environment in the US, where testing on public roads has traditionally been subject to fewer mandatory federal requirements, European regulatory approaches have generally favoured more controlled testing conditions, often limiting trials to private roads,

⁸ Council Directive 85/374/EEC of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, *Official Journal of the European Communities*, L 210.

⁹ Directive 2009/103/EC of the European Parliament and of the Council of 16 September 2009 relating to insurance against civil liability in respect of the use of motor vehicles, and the enforcement of the obligation to insure against such liability (Codified version), *Official Journal of the European Union*, L 263.

¹⁰ Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act), *Official Journal of the European Union*, L, 12.7.2024.

predefined routes, controlled environments, or at low speeds (Taeihagh & Lim, 2018 p. 109). This reflects a broader regulatory emphasis on public safety and regulatory oversight before permitting large-scale deployment of autonomous driving technologies.

A further component of the EU regulatory framework is provided by Regulation (EU) 2019/2144 on type-approval requirements for motor vehicles, commonly referred to as the *General Safety Regulation* (GSR II).¹¹ The Regulation establishes mandatory safety requirements for vehicles placed on the EU market and provides the legal basis for developing type-approval requirements for certain automated driving systems. By introducing harmonised technical requirements for advanced vehicle safety functions, cybersecurity, and automated driving technologies, the Regulation seeks to ensure that autonomous vehicles placed on the EU market meet applicable safety standards as part of the type-approval process. However, rather than establishing a comprehensive regulatory regime for autonomous vehicle, the Regulation operates within the broader EU type-approval framework, complementing existing liability, insurance, and AI-related rules through a preventive approach focused on vehicle safety and technical compliance.¹²

Consequently, while the EU regulatory framework establishes common principles concerning safety, liability, and type approval, significant aspects of autonomous vehicle deployment remain dependent on national regulatory initiatives. This has led several Member States, particularly Germany and France, to adopt more specific legislative frameworks addressing the operational deployment of autonomous vehicles.

3.4. Germany:

A Comprehensive Regulatory Framework for Autonomous Vehicles

Germany has emerged as a pioneer in the legal regulation of autonomous vehicles through the gradual development of a comprehensive legislative framework governing increasingly higher levels of vehicle automation. The *Automated Driving*

¹¹ Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) No 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166 (Text with EEA relevance), *Official Journal of the European Union*, L 325, 16.12.2019, pp. 1–40.

¹² General Safety Regulation, Arts. 6–11.

Act (2017)¹³ established the legal basis for the operation of SAE Level 3 autonomous vehicles,¹⁴ while the *Act Amending the Road Traffic Act and the Compulsory Insurance Act (Act on Autonomous Driving 2021)*¹⁵ marked a significant regulatory milestone by making Germany the first jurisdiction to adopt a comprehensive legal framework for the operation of SAE Level vehicles (Csitei, 2021, p. 56). This legislative reform was subsequently complemented by a federal ordinance adopted in February 2022, which operationalised the statutory framework by prescribing the technical and procedural requirements for the deployment of autonomous vehicles and amending existing road traffic legislation to facilitate their integration into public road transport (Nolte *et al.*, 2025, p. 5).

The legislative reform, formally enacted as the *Act Amending the Road Traffic Act and the Compulsory Insurance Act*, establishes the legal basis for the operation of motor vehicles equipped with automated driving functions capable of performing the entire dynamic driving task without human intervention. Rather than permitting unrestricted deployment, the Act adopts a cautious, risk-based regulatory approach by restricting the operation of such vehicles to predefined and officially approved operating areas (defined operating areas).¹⁶ Within these areas, auton-

¹³ Ahtes Gesetz zur Änderungen des Straßenverkehrsgesetzes, *Bundesgesetzblatt Jahrgang 2017 Teil I Nr. 38*, ausgegeben zu Bonn am 20. Juni 2017.

¹⁴ Autonomous vehicles are commonly classified according to the six-level taxonomy developed by the Society of Automotive Engineers (SAE), which distinguishes vehicles based on the degree of driving automation. At SAE Levels 1 and 2, the human driver remains responsible for the dynamic driving task, notwithstanding the availability of driver-assistance functions. By contrast, at Levels 3 through 5, the automated driving system assumes responsibility for performing the dynamic driving task, although Level 3 still requires the human driver to intervene when requested. Full automation is achieved at Levels 4 and 5. Level 4, or high driving automation, is defined as a level at which the system performs all driving tasks under specific and predefined conditions. Level 5, or full driving automation, represents the highest level of automation, at which the system performs all driving tasks under all driving and environmental conditions, without requiring driver intervention. In other words, Level 5 vehicles are capable of operating fully autonomously under all driving and environmental conditions (SAE, 2021, p. 4). The SAE classification has been widely adopted as a reference framework for driving automation by international and national regulatory and policy-making bodies. It has informed the development of legal and policy frameworks in several jurisdictions, including the Australian National Transport Commission (NTC), the UK's Department for Transport (DfT), the US National Highway Traffic Safety Administration (NHTSA), the Government of Ontario, Canada, and the European Road Transport Research Advisory Council (Taeihagh & Lim, 2018, p. 106).

¹⁵ Gesetz zur Änderung des Straßenverkehrsgesetzes und des Pflichtversicherungsgesetzes – Gesetz zum autonomen Fahren, *Bundesgesetzblatt Jahrgang 2021 Teil I Nr. 48*, ausgegeben zu Bonn am 27. Juli 2021.

¹⁶ *Act amending the Road Traffic Act and the Compulsory Insurance Act – Act on Autonomous Driving*, Art. 1d.

omous vehicles are legally permitted to perform the driving task independently, provided that the statutory and technical requirements prescribed by the regulatory framework are satisfied. By restricting the operation of vehicles equipped with autonomous driving functions to predefined operating areas, the German legislature adopts a functional approach to regulation, whereby the scope of legal authorisation is determined not only by the technical capabilities of the automated driving system but also by the features of its intended operational environment.

The Act governs several key aspects of the deployment and operation of autonomous vehicles. It establishes procedures for obtaining an operating permit, including applicable testing requirements, and sets out the conditions for the type approval of autonomous vehicle models for use on public roads. The Act also prescribes the requirements for vehicle registration and defines the respective obligations of manufacturers, owners, and operators.¹⁷ In addition, it regulates testing procedures, specifies the administrative process for obtaining operational authorization, and establishes administrative and civil liability for non-compliance. Finally, the Act sets out the technical requirements and performance standards applicable to Level 4 autonomous vehicles (Eastman *et al.*, 2023, p. 30).

From a regulatory perspective, one of the Act's most significant features is the allocation of approval authority to the competent public authorities. The legislation requires administrative authorisation not only for the autonomous vehicle itself but also for the specific operational domain in which it is intended to operate.¹⁸ This dual authorisation mechanism reflects a preventive regulatory model, whereby compliance with technical, operational, and safety requirements is subject to *ex ante* administrative oversight.¹⁹ Consequently, the German framework represents a structured

¹⁷ The regulation expressly allocates legal responsibilities not only to manufacturers but also to vehicle owners and operators. In particular, vehicle owners are required to ensure the continued operational safety of the automated driving system by conducting pre-departure safety inspections, arranging periodic technical inspections by qualified personnel (i.e., mechanics or engineers) at intervals not exceeding 90 days, and demonstrating that the automated driving function can be safely deactivated where required. These obligations reflect the legislature's intention to distribute responsibility for the safe operation of SAE Level 4 vehicles beyond the manufacturer and to impose ongoing compliance obligations on those responsible for their operation (Malterer, 2022).

¹⁸ The authorisation procedure comprises two distinct administrative stages. First, an operating permit for the autonomous driving system must be obtained from the Federal Motor Transport Authority (*Kraftfahrt-Bundesamt*). Second, the competent authority of the relevant federal state must authorise the deployment of one or more vehicles of an approved type within a defined operating area. Such authorisation may be granted only after the operational domain has been specified and in consultation with the competent local authority, thereby reflecting the Act's dual administrative approval model (Malterer, 2022).

¹⁹ *Act Amending the Road Traffic Act and the Compulsory Insurance Act – Act on Autonomous*

regulatory model that combines detailed technical standards with administrative authorisation mechanisms to facilitate the gradual deployment of vehicles equipped with autonomous driving functions while maintaining regulatory oversight over their operation. From a comparative law perspective, this approach illustrates a preference for administrative supervision as the principal mechanism for managing the legal risks associated with the deployment of autonomous vehicles.

3.5. France: *An Incremental and Sector-Specific Regulatory Framework for Autonomous Vehicles*

France's regulatory approach to autonomous vehicles was initiated through the adoption of the *French National Strategy on the Development of Autonomous Vehicles* in 2018, which was subsequently updated in 2022.²⁰ The Strategy established the strategic and regulatory foundations for the integration of autonomous vehicles into the national transport system and serves as the principal policy framework guiding subsequent legislative and regulatory reforms, particularly with regard to ethical standards, insurance, liability allocation, and the adaptation of transport infrastructure. These policy objectives were subsequently translated into legislation through the *Mobility Orientation Law (Loi d'orientation des mobilités)*, enacted on 24 December 2019.²¹ The Act establishes a broader framework for sustainable mobility while also providing a legal basis for the deployment of autonomous vehicles beyond the experimental phase. It further provides for the collection and use of vehicle-generated data for traffic management and incident reporting and authorises the adoption of implementing measures governing the provision of autonomous mobility services (Eastman *et al.*, 2023, p. 26). This approach reflects a gradual and adaptive regulatory strategy, whereby legislative intervention has evolved alongside technological progress and practical experimentation rather than through the immediate establishment of a comprehensive authorisation regime.

Building upon this legislative framework, France further developed its regulatory regime for autonomous vehicles through *Ordinance No. 2021-443* of April 2021,²²

Driving of 12 July 2021, Art. 1e.

²⁰ *Development of Automated and Connected Road Mobility – State of Play, Challenges and Actions for the National Strategy*, 2023, p. 2.

²¹ LOI n° 2019-1428 du 24 décembre 2019 d'orientation des mobilités, *Journal officiel de la République française* n° 0299 du 26 décembre 2019, <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000039666574>.

²² Ordinance no 2021-443 du 14 avril 2021 relative au régime de responsabilité pénale applicable en cas de circulation d'un véhicule à délégation de conduite et à ses conditions d'utilisation,

which introduced more specific rules governing their deployment and operation. The Ordinance addresses three principal areas: criminal liability in the context of autonomous vehicles, the conditions governing their use, and the safety requirements applicable to these systems. It provides that, where an automated driving system fails to comply with applicable operational requirements, the manufacturer may incur civil liability for any resulting damage.²³ In addition, the Ordinance establishes a legal framework governing access to vehicle-generated data while automated functions are activated, identifying the entities entitled to access such data, including national police authorities, vehicle registration holders, and authorised public or private actors responsible for investigating relevant incidents involving vehicle-generated data.²⁴

Complementing this regulatory framework, France further facilitated the practical development of autonomous vehicles by expanding its experimentation regime in 2021 to permit the testing of vehicles capable of operating without a driver on board.²⁵ This regulatory evolution was intended to support a gradual transition from experimental deployment towards higher levels of vehicle automation, with the objective of enabling SAE Level 4 testing by the end of 2022.²⁶ However, by September 2022, the French authorities had introduced only the regulatory framework for SAE Level 3 deployment (Eastman *et al.*, 2023, p. 28).

Building upon its earlier regulatory reforms, France further strengthened its legal framework through *Decree No. 2024-1063* of 25 November 2024,²⁷ which estab-

Journal officiel de la République française n° 0089 du 15/04/2021. <https://www.legifrance.gouv.fr/eli/ordonnance/2021/4/14/TRAT2034523R/jo/texte>.

²³ *Ordinance no 2021-443*, Art. L 123-2.

²⁴ *Ordinance no 2021-443*, Art. L 123-3.

²⁵ As of 2018, French public-road testing activities encompassed three main categories of autonomous vehicle experiments: (1) motorway and expressway trials involving SAE Levels 2-4 systems; (2) low-speed urban trials at SAE Levels 2-4 and addressing more complex interactions with road users and vehicle positioning requirements; and (3) very-low-speed urban public transport experiments involving SAE Levels 4-5 vehicles operating along predefined routes, primarily small autonomous shuttles with a capacity of four to eight passengers. A notable example within the latter category is the EZ10 driverless shuttle, which was authorised to operate autonomously on a public road in Toulouse and became the first fully autonomous vehicle approved for public-road operation in Europe. Operating at SAE Level 4, the shuttle was permitted to perform driving functions autonomously within a defined operational domain and subject to specific route limitations (Bateman, 2021).

²⁶ In parallel, French stakeholders supported the development of dedicated testing environments, such as *Transpolis*, an 80-hectare experimental site designed to evaluate automated vehicles under realistic traffic conditions while reducing reliance on public road infrastructure.

²⁷ Décret no 2024-1063 du 25 novembre 2024 relatif au transport routier automatisé de marchandises, *Journal officiel de la République française*, n° 0280 du 27/11/2024, <https://www.legifrance.gouv.fr/eli/decret/2024/11/25/PTDT2408874D/jo/texte>.

lishes detailed rules governing the deployment and operation of autonomous road freight transport systems. The Decree is particularly significant because it moves beyond the regulation of testing activities and provides a comprehensive framework for the operational use of autonomous freight vehicles, including requirements relating to safety demonstrations, allocation of responsibilities among system operators and other stakeholders, operational supervision, and regulatory oversight.²⁸ The Decree is also aligned with the broader European regulatory framework, including Regulation (EU) 2019/2144 and Regulation (EU) 2022/1426²⁹ governing the type approval of automated driving systems (the ADS Regulation), while extending beyond vehicle approval to regulate the operational deployment and use of autonomous road freight transport in real-world conditions.³⁰ It therefore represents one of the most comprehensive national regulatory frameworks for the commercial deployment of highly automated freight transport in Europe. From a comparative law perspective, the French framework demonstrates a strategy of incremental regulatory development, combining policy guidance, legislative adaptation, experimental mechanisms, and a comprehensive operational framework for autonomous road freight transport to address the legal challenges arising from the deployment of autonomous vehicles.

3.6. Australia:

A Regulatory Framework for Autonomous Vehicles and Safety Assurance

Australia has recently advanced the development of a comprehensive regulatory framework for the future commercial deployment of autonomous vehicles. The proposed national safety framework is intended to regulate the safety of autonomous vehicles across their lifecycle, while their practical deployment remains subject to further legislative and regulatory implementation. Following the decision to support conditional deployment from 2027 in selected locations, Australia is transitioning from the development of its national safety framework towards controlled commercial deployment. The regulatory approach is structured around three principal phases of oversight: (1) first-supply regulation, governing the initial placement of automated

²⁸ *Décret no 2024-1063 du 25 novembre 2024 relatif au transport routier automatisé de marchandises*, Art. R. 3251-1.

²⁹ Commission Implementing Regulation (EU) 2022/1426 of 5 August 2022 laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of the automated driving system (ADS) of fully automated vehicles, *Official Journal of the European Union*, L 221. 26.8.2022, pp. 1–64.

³⁰ French Ministry for Ecological Transition (2025), *National Strategy for Automated and Connected Road Mobility (2025–2027)*, p. 9.

vehicles on the market; (2) in-service regulation, addressing the operation and ongoing compliance of automated vehicles throughout their lifecycle; and (3) state and territory road transport regulation, encompassing matters within the jurisdiction of subnational road transport authorities (Eastman *et al.*, 2023, p. 2).

Under Australia's proposed regulatory framework, autonomous vehicles enter the commercial market through the existing first-supply regime, which governs the initial placement of vehicles on the market. This framework distinguishes between type-approval and non-type-approval pathways, with the former expected to apply to the vast majority of automated vehicles and the latter reserved for limited, case-specific circumstances (Eastman *et al.*, 2023, p. 3). An entity seeking type approval from the National Transport Commission (NTC)³¹ assumes the role of the Automated Driving System Entity (ADSE) and remains legally responsible for the vehicle throughout its operational lifecycle, thereby becoming subject to the in-service obligations established under the proposed *Automated Vehicle Safety Law* (NTC Policy Paper, 2022, p. 22).

The type-approval process is based on self-certification, requiring the ADSE to demonstrate compliance with the Australian Design Rules (ADRs) through evidence addressing eleven core regulatory requirements, including system safety and validation, the operational design domain, the human-machine interface, compliance with road traffic laws, interaction with public authorities, risk management, driving performance, software updates, adaptation to Australian road conditions, cybersecurity, and user education. In addition, applicants must demonstrate their capacity to support the vehicle for a minimum of seven years by maintaining an established corporate presence, satisfying prescribed financial requirements, and ensuring ongoing data-recording and data-sharing capabilities (NTC Policy Paper, 2022, pp. 22–23).

Given that autonomous vehicles may be modified or updated throughout their operational lifecycle, the proposed Australian framework extends the responsibilities of the ADSE to the ongoing safety of the vehicle while in service. The ADSE is subject to a general safety duty requiring it to ensure the safe operation of autonomous vehicles, assessed against the standard of what is reasonably practicable or reasonably foreseeable (Eastman *et al.*, 2023, p. 4). This risk-based obligation places primary responsibility for identifying and mitigating safety risks on the ADSE as the entity best positioned to manage them. To demonstrate compliance, the ADSE must submit a statement of compliance supported by a safety case evidencing conformity with the applicable Australian Design Rules. In addition to the

³¹ The National Transport Commission (NTC) is Australia's national land transport reform agency, statutorily mandated to develop, maintain, and monitor nationally consistent regulatory and operational frameworks for road, rail, and intermodal transport, including reforms addressing emerging transport technologies (NTC Policy Paper, 2023).

general safety duty, the framework envisages specific prescriptive safety obligations, expected to cover areas such as safety management, prevention of unsafe operation, notification of safety risks, data recording, education and training, and compliance with road traffic laws (NTC Policy Paper, 2021, p. 25).

An autonomous vehicle reaches the end of its regulatory lifecycle once it is no longer supported by an ADSE,³² after which its automated driving functions may no longer be lawfully operated on public roads (Eastman *et al.*, 2023, p. 5). From a comparative law perspective, the Australian approach reflects a safety-assurance model in which regulatory responsibility is allocated primarily to the entity controlling the automated driving system, combining self-certification with continuing lifecycle obligations.

3.7. Comparative Assessment of Regulatory Models

The comparative legal analysis demonstrates that, despite significant differences in legislative structure and regulatory maturity, the jurisdictions examined exhibit a common trend towards a gradual transition from traditional driver-centred regulation to governance models centred on the safety, supervision, and responsibility of autonomous vehicles. While the US continues to rely on a fragmented allocation of regulatory responsibilities between federal and state authorities, the UK, Germany, France, and Australia have increasingly adopted more comprehensive regulatory approaches combining ex ante safety assurance, institutional responsibility, lifecycle supervision, and adaptive regulatory oversight. At the same time, the EU provides a harmonised framework for vehicle safety, type approval, product liability, and artificial intelligence, while leaving the operational deployment of autonomous vehicles largely to national legislation. These developments illustrate that the legal challenges posed by autonomous vehicles can no longer be addressed solely through traditional liability rules but require integrated regulatory frameworks governing their entire lifecycle. Against this comparative background, the following chapter examines the national legislative framework to assess its degree of alignment with these emerging international regulatory trends and to identify potential areas for further legal development.

³² The Australian framework distinguishes between minor and significant modifications to autonomous vehicles during their operational lifecycle. Minor modifications may be implemented without notification to the in-service regulator, provided they do not affect the vehicle's level of automation, operational design domain, or safe operation. By contrast, significant modifications require the ADSE to self-certify to the in-service regulator that the modified vehicle continues to satisfy the safety standards established during the first-supply approval process. The precise scope of a "significant modification" is to be defined under the proposed *Automated Vehicle Safety Law* (NTC Policy Paper, 2022, pp. 51–52).

4. Regulating Autonomous Vehicles in Serbia: From Experimental Testing to a Comprehensive Regulatory Framework

Alongside pioneering jurisdictions such as the US, the UK, and Germany, Serbia has recently taken significant steps towards establishing a regulatory framework for autonomous driving. This development has been marked by the amendments to the *Law on Road Traffic Safety*,³³ followed by the enactment of the *Rulebook on the Conditions for Autonomous Driving*.³⁴ Taken together, these legislative and regulatory measures have established a normative framework governing the testing of autonomous vehicles on public roads in the Republic of Serbia. At its present stage of development, however, the applicable regulatory framework remains limited to the testing of autonomous vehicles, thereby constituting an initial, yet important, step towards their broader legal regulation and eventual deployment in Serbia (Sovilj, 2024, p. 39). The establishment of this framework enabled the issuance of permits authorising the testing of two SAE Level 3 autonomous vehicles, placing Serbia, at the time of its adoption, among the limited number of European jurisdictions to have established a comparable legal basis for autonomous vehicle testing. The autonomous vehicles tested on the streets of Belgrade in 2023 were developed by the Autonomous Driving Group (Petaković, 2023).

Under the law, an autonomous vehicle is defined as a manufactured or modified motor vehicle equipped with an automated driving system that complies with the prescribed technical and other requirements and enables the vehicle to operate in road traffic with the driver exercising partial control over the vehicle or without any no driver control.³⁵ The statutory definition encompasses two distinct categories of motor vehicles: those originally manufactured with an automated driving system and those subsequently modified to incorporate such a system. While this distinction may appear primarily technical, it carries potentially significant legal implications for the allocation of responsibility for the safety, compliance, and proper functioning of the automated driving system following its subsequent integration into the vehicle. This raises the broader question of whether a vehicle retrofitted with an automated driving system should, for legal purposes, be subject to the same regulatory treatment and liability framework as a vehicle originally designed and manufactured as an autonomous vehicle. In particular, the regulatory framework would benefit from greater clarity regarding the allocation of responsibility among the vehicle manufacturer, the entity

³³ Zakon o bezbednosti saobraćaja na putevima, *Službeni glasnik RS*, br. 41/2009, 53/2010, 101/2011, 32/2013 - odluka US, 55/2014, 96/2015 - dr. zakon, 9/2016 - odluka US, 24/2018, 41/2018, 41/2018 - dr. zakon, 87/2018, 23/2019, 128/2020 - dr. zakon i 76/2023.

³⁴ Pravilnik o uslovima za obavljanje autonomne vožnje, *Službeni glasnik RS*, br. 104/2023.

³⁵ *Serbian Law on Road Traffic Safety (Zakon o bezbednosti saobraćaja na putevima)*, Art. 7, para. 1, item 105.

performing the modification, the operator, and other potentially relevant actors where an automated driving system is subsequently incorporated into an existing vehicle.

In addition, the statutory reference to vehicle operation “without any driver control” is of particular legal significance. This formulation challenges the traditional legal conception of the driver as the person exercising actual control over the vehicle and raises the question of whether, and to what extent, the notion of the “driver” retains its conventional legal meaning where the dynamic operation of the vehicle is entrusted entirely to an automated driving system. It consequently necessitates a reconsideration of the allocation of legal responsibility for the operation of the vehicle, including responsibility for traffic violations, failures of the automated driving system, and damage caused during autonomous operation (Mrvić Petrović, 2023, pp. 39–41). In this context, particular attention should be given to the respective legal roles and responsibilities of the vehicle operator, manufacturer, and software developer or provider of the automated driving system. In contrast to the UK and Australian models, which expressly allocate continuing responsibilities to designated entities, the Serbian framework does not yet establish a comparable institutional mechanism for allocating responsibility throughout the vehicle’s operational lifecycle.

The Rulebook lays down more detailed provisions governing the testing of autonomous vehicles, stipulating that such testing may be carried out by a legal entity having its registered office in the Republic of Serbia on the basis of a permit issued by the territorially competent organisational unit of the Ministry of Internal Affairs in whose area the testing is conducted. The permit may be issued for one or more autonomous vehicles of vehicle category L7 with a factory-enclosed M1 or N1 body,³⁶ operating at up to and including SAE Level 4 driving automation, for a period not exceeding one year.³⁷ In this context, it is important to note that both the *Law on Road Traffic Safety* and the

³⁶ Category L7 (heavy quadricycle) means a motor vehicle with four wheels, the unladen mass of which does not exceed 400 kilograms, or 550 kilograms in the case of vehicles intended for the carriage of goods, excluding the mass of batteries where the vehicle is electrically powered, and whose maximum continuous rated power does not exceed 15 kilowatts. Category L generally comprises mopeds, motorcycles, motor tricycles and quadricycles. Category M1 (passenger car) means a vehicle of category M with no more than nine seating positions, including the driver’s seat, and with no standing places. Vehicles of category M are vehicles designed and constructed primarily for the carriage of persons and their luggage. Category N1 means a vehicle of category N with a maximum permissible mass not exceeding 3.5 tonnes. Vehicles of category N are motor vehicles designed and constructed primarily for the carriage of goods. Serbian Rulebook on the classification of motor and trailing vehicles (Pravilnik o podeli motornih i priključnih vozila i tehničkim uslovima za vozila u saobraćaju na putevima, *Službeni glasnik RS*, br. 40/2012, 102/2012, 19/2013, 41/2013, 102/2014, 41/2015, 78/2015, 111/2015, 14/2016, 108/2016, 7/2017 - ispr., 63/2017, 45/2018, 70/2018, 95/2018, 104/2018, 93/2019, 2/2020 - ispr., 64/2021, 129/2021 - dr. pravilnik, 143/2022, 110/2022 - dr. pravilnik, 48/2023, 24/2024, 101/2024, 53/2025 i 54/2026), Arts. 6–8.

³⁷ Serbian Rulebook on the Conditions for Autonomous Driving, Art. 3.

Rulebook remain insufficiently clear as to the source and basis of the classification of driving automation levels (Živanović, 2024, p. 839). In particular, while the *Rulebook* permits the testing of autonomous vehicles up to and including SAE Level 4, the *Law on Road Traffic Safety* does not expressly specify the applicable level of driving automation, nor does it identify the classification system or standard on which such levels are based. Taking into account the operational scope and the level of driving automation of the vehicle, the competent authority may, when issuing the permit and having regard to the specific circumstances of each application, prescribe safety measures concerning the duration and period of testing; the number of tests; weather conditions; the roads and routes on which testing may be conducted; the driver and other persons who may be present in the vehicle during testing; the driver's duty to exercise supervision; and the organiser's obligation to discontinue testing if road traffic safety is compromised.³⁸

The principal structural limitation of the Serbian framework is therefore not the absence of regulation as such, but the absence of a regulatory architecture connecting testing, authorisation, deployment, institutional responsibility, and lifecycle oversight. From a *de lege ferenda* perspective, the Serbian regulatory framework should evolve beyond its current focus on the experimental testing of autonomous vehicles towards a comprehensive regime governing their deployment and operation in road traffic. Such a development would require, first, the establishment of clearer rules governing the allocation of legal responsibility among drivers, vehicle owners and operators, manufacturers, software developers and providers of automated driving systems, and other actors involved in the deployment and operation of autonomous vehicles, as well as clear rules governing human oversight and the transition of control between the driver and the automated driving system. Second, the regulatory framework should provide for an insurance regime specifically adapted to the risks associated with automated driving, including situations in which liability may no longer be attributable exclusively to human drivers. Third, specific rules should govern the collection, storage, access to, and use of data generated during autonomous operation, particularly where such data are relevant to determining the causes of an incident or allocating liability. Fourth, given the increasing reliance of automated driving systems on software and network connectivity, the regulatory framework should expressly address cybersecurity and software-related safety risks, including requirements concerning system updates, vulnerabilities, and the continued safety of automated driving functions. Finally, the existing permit-based system would benefit from a clearer mechanism of continuous regulatory oversight following the issuance of a testing permit, including monitoring compliance with prescribed safety requirements and empowering the competent authority to intervene where road traffic safety is subsequently compromised. Taken together, these measures would enable the Serbian legal framework to progress from

³⁸ Serbian *Rulebook on the Conditions for Autonomous Driving*, Art. 7.

its current partial, testing-oriented approach towards a comprehensive and technologically neutral regulatory framework capable of addressing the legal, safety and liability challenges arising from the wider deployment of autonomous vehicles.

5. Conclusion

The comparative analysis demonstrates that the regulation of autonomous vehicles is evolving through different legal and institutional models, while several common regulatory concerns increasingly shape these frameworks. Despite differences in regulatory maturity, institutional structures, and legislative techniques, the jurisdictions examined reveal a broader shift away from driver-centred regulation towards ex ante safety assurance, institutional responsibility, and continuous lifecycle oversight. The analysis therefore indicates that the legal regulation of autonomous vehicles cannot be effectively addressed through traditional liability rules alone, but increasingly requires regulatory mechanisms capable of governing the operation and safety of automated driving systems throughout their lifecycle.

The Serbian regulatory framework has evolved from an initial absence of specific regulation towards a partial regulatory framework, but remains primarily focused on the testing of autonomous vehicles and does not yet provide a comprehensive basis for their broader deployment and operation. The comparative analysis does not support the transplantation of any single foreign regulatory model; rather, it suggests that Serbia could selectively combine regulatory mechanisms developed in different jurisdictions, adapting them to its own institutional and legal context. The future evolution of Serbian autonomous vehicle regulation should therefore build upon the existing testing regime by gradually introducing clearer rules on liability, safety assurance, operational authorisation, and lifecycle oversight. Such development would enable Serbia to move towards a more coherent and technologically adaptable regulatory regime capable of supporting the safe and legally certain authorisation and operation of autonomous vehicles, accompanied by continuous regulatory oversight throughout their operational lifecycle.

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